



US Army Corps
of Engineers

Operating Plans and Procedures for The U.S. Army Corps of Engineers National HF-SSB Emergency Communications Network

FOREWORD

THIS COMMUNICATIONS PLAN WAS DEVELOPED AS A LIVING, WORKING DOCUMENT TO SERVE AS A BASIC GUIDE FOR THE OPERATIONS AND DEVELOPMENT OF A VIABLE AND FUNCTIONING CORPS OF ENGINEERS HF RADIO NETWORK. THE INFORMATION CONTAINED HEREIN SERVES ONLY AS A GUIDE AND A BASIC STRUCTURE OF OPERATIONS FROM WHICH TO BEGIN. SINCERE APPRECIATION AND GRATITUDE IS EXTENDED TO ALL WHO REVIEWED AND COMMENTED ON ITS CONTENTS, ESPECIALLY MR. TOM PRYOR, CHIEF OF RADIO OPERATIONS, VICKSBURG DISTRICT, FOR HIS UNTIRING EFFORTS AND CONTRIBUTIONS IN ORGANIZING AND ASSEMBLING THIS DOCUMENT. ALL SUGGESTED CHANGES FOR ITS IMPROVEMENT WILL BE SUBMITTED TO HQUSACE, ATTN: CEIM - RT, 20 MASS. AVE. N.W. WASH., D.C. 20314 - 1000

WASHINGTON, D.C.

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CEIM - RT

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INTRODUCTION

Historically the Corps of Engineers has not had Corps wide Continental United States (CONUS) radio communications capability due to the lack of compatible High Frequency Single Sideband (HF/SSB) equipment. With the acquisition of 1Kw (HF/SSB) radios for HQUSACE and each division and district in CONUS we now have excellent, compatible radio equipment to support emergency operations. To become and remain proficient over an extended period of time, it will be necessary for the operators to participate in frequent on-the-air training nets established by this manual. The manual additionally describes military radio procedures sufficient to communicate with military installations when necessary. Provisions have been made to allow informal training sessions on the air for sharing information and asking specific questions regarding operating procedures etc. As changes to the manual become necessary amendments will be published and distributed by the proponent activity, Lower Mississippi Valley Division.

FREQUENCIES

The Corps of Engineers has authorization to operate on the following High Frequency (HF) single side band (SSB) frequencies:

<u>Channel</u>	<u>Frequency</u>	<u>Side Band</u>
1	3345 KHz	USB
2	5015 "	"
3	5327.5 "	"
4	5400 "	"
5	5437.5 "	"
-6	6020 "	"
7	6785 "	"
8	9122.5 "	"
9	11693.5 "	"
10	12070 "	"
11	12267 "	"
12	16077 "	"
13	16382 "	"

In addition, a memorandum of understanding with Federal Emergency Management Agency (FEMA) authorizes the Corps to operate on the two HF/SSB frequencies below during emergencies:

14	5211 KHz	USB
15	10493 KHz	USB

Note: All frequencies shown are center frequencies. They are operated on Upper Side Band. To avoid confusion refer to channel numbers shown on preceeding page rather than frequency

SCANNING RECEIVER

All 13 frequencies authorized for USACE use will be programmed into the scanning receiver. When the HF radio is manned for actual emergency situations or routine practice nets, the scanning receiver will be activated.

PROPAGATION CHANNEL/FREQUENCY SELECTION

To select the best Channel/Frequency for propagation between stations at any particular time, the Mackay Personal Computer equipment component contains a Propagation Calculation software program that may be used. The program requires inputting the longitude and latitude of the originating station and the destination, the date, and sunspot number. The longitude and latitude of each CONUS Division/District is contained in Appendix D of this manual. Solar flux values are broadcast in voice on WWV at 18 minutes after each hour on frequencies 5.0, 10.0, 15.0, and 20.0 MHz. To convert the Solar Flux values to the required Sun Spot Number (SSN): $SSN = 1.6(SF-73.4)$. The output of the program will show the maximum useable frequency (MUF).

ZULU TIME

Zulu time will be used by the Corps radio nets. This is the same as Greenwich Mean Time (GMT). Radio station WWV broadcasts this time at one minute intervals on frequencies 5.0, 10.0, 15.0 and 20.0 MHz. By using this time the difference in the time zones throughout CONUS pose no problem. The date time group (DTG) on all messages will be in Zulu time, designated by a "Z" at the end.

Note: Zulu time does not change when standard time converts to and from Daylight Saving Time. See Appendix B for Standard Time Conversion Chart.

CRITICAL RELAY STATIONS

Two division stations, Omaha (CEMRD) and San Francisco (CESPD) as well as two districts, Huntington (CEORD) and Albuquerque (CESWD), have been designated as critical relay stations (CRS) for the Division/Division Net. These stations have been selected due to their geographical locations with respect to the net control station (NCS) at CELMVD and all other stations in the net. Omaha has also been designated as alternate net control station (ANCS). These stations will stand ready to relay radio traffic as necessary in event NCS can not communicate directly with stations in the net.

Huntington and Albuquerque are the only two districts that will routinely participate as relay stations in this net. However, any station may be asked by NCS to relay traffic.

RADIO NETS

- A. A radio net is made up of two or more radio stations communicating with each other on a common frequency.
- B. The Division/Division HF/SSB Net as outlined in this document will be controlled by the NCS (CELMVD) or the ANCS (CEMRD).

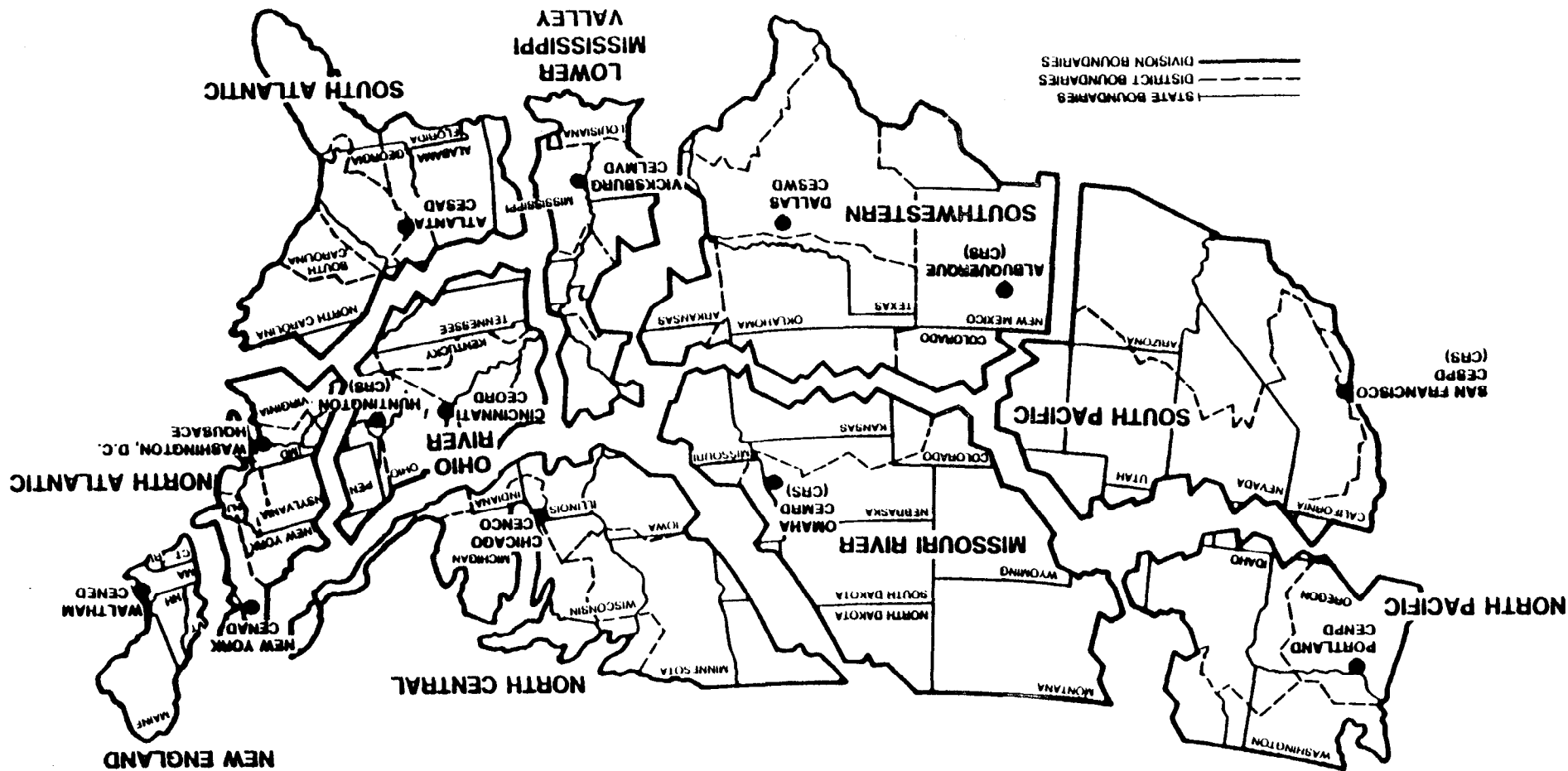
- C. Each USACE Division will also establish and operate a separate weekly training Net with their districts.
- D. Training nets will operate on voice and be used to train operators in proper radio procedures.
- E. During the course of the net operation participants may be directed to switch from VOICE to DATA mode for radioteletype (RTTY) or other types of operation.
- F. Net members may be tasked to have a practice message ready to transmit to another station in the training net.
- G. The instructions herein contain all the information required to prepare and transmit messages.
- H. District or division stations may pass traffic to any other district/division at anytime so long as their traffic doesn't interfere with a training or emergency net in progress.
- I. In an emergency situation the net may be activated using the same guidelines as during training exercises.

DIVISION/DISTRICT NETS

Weekly training nets will be established and operated by each USACE Division office with their districts (LAW FM 11-490-7).

Net call will be made utilizing a slant bar and the letter "B" after the USACE Division call sign. Example: Net call for CEORD will be WUE/B. Frequencies and time of day are left to the discretion of the respective USACE Divisions. In order to eliminate the possibility of interference between division nets the following days of the week will be utilized to conduct the training nets:

Monday - South Pacific Division
 South Atlantic Division
 Ohio River Division



DIVISION/DIVISION NET



Tuesday - North Pacific Division
 North Atlantic Division
 South West Division
 North Central Division

Wednesday - Lower Mississippi Valley Division
 Missouri River Division

When the training day falls on a federal holiday, the training will resume the following week.

Each division will keep HQUSACE, NCS/CELMVD and the ANCS/CEMRD advised of time of day and channel number used in their training nets.

The division office shall maintain a log recording time & ... of each station successfully joining to net during these tests.



The Division/Division Net is established and will operate as follows:

DAY OF WEEK	TIME	CHANNEL
Friday	1500Z	8
	1530Z	10
	1600Z	12
NET MEMBERS:		
	LOCATION	CALL SIGN
HQUSACE	Washington, DC	WUO
NCS CELMVD	Vicksburg, MS.	WUG
ANCS (CRS) CEMRD	Omaha, NB	WUH
CENED	Waltham, MA.	WUA
CENAD	New York, NY	WUB
CENCD	Chicago, IL.	WUD

	CENPD	Portland, OR	WUJ
	CEORD	Cincinnati, OH	WUE
	CESAD	Atlanta, GA	WUC
CRS	CESPD	San Francisco, CA	WUK
	CESWD	Dallas, TX	WUI
CRS	CESWD	Albuquerque Dist	WUI-5
CRS	CEORD	Huntington Dist	WUE-4

Net call will be WUG/A

Each member station will attempt to check into this net either direct or through one of the critical relay stations. If an attempt at 1500Z on ch. 8 is not successful a second or third attempt will be made on ch. 10 or 12 at the proper time.

When successfully entering the net, the division shall transmitt the complete list of participants from the Div/Dist net which successfully entered that net during the test which occurred IAW para 4

1.0. GENERAL

ONLY UNCLASSIFIED MESSAGES MAY BE TRANSMITTED BY RADIO. NEVER TRANSMIT CLASSIFIED PLAIN TEXT INFORMATION ON THE AIR.

A. The ability to maintain efficient communications under all circumstances depends on adherence to standardized operating procedures. It is only through a thorough working knowledge of these procedures, followed by periodic training and application of the principles involved that proficiency can be attained.

B. The instructions contained herein are sufficiently comprehensive to govern Army Corps of Engineers operations during emergency conditions. A degree of flexibility is provided and at the same time, basic communication principles have been preserved. Instances may arise in which a specific operating requirement is not completely covered by these instructions. Under such circumstances, common sense and initiative must prevail.

C. The instructions in this chapter are devoted to those of basic message preparation and handling procedures which apply equally to all means of communication covered in succeeding sections.

The NCS shall compile this list & transmit to Hqs. at the conclusion of the Div/DIV test.

1. Fundamentals. Reliability, security and speed are the three fundamentals of good communications. Reliability is always paramount. It must never be diminished nor sacrificed to meet the conflicting demands of speed or convenience.

2. Transmission Practices. All transmissions shall be as short and concise as possible; consistent with clarity.

a. The following practices are forbidden:

- (1) Violation of radio silence whenever imposed.
- (2) Use of profane, indecent, or obscene language.
- (3) Use of other than authorized prosigns, prowords, or operating signals.
- (4) Transmitting in a directed net without permission.

b. The following practice will be avoided:

- (1) Transmitting at speed beyond the capability of the receiving operator.

1-1 OPERATIONAL CONTROL

A. Responsibilities of NCS:

1. Open and close net at exact scheduled time.
2. Prove the identity of reporting station through authentication as deemed necessary.
3. Monitor for operation within authorized frequency tolerance and for spurious and substandard emission.
4. Expedite the clearing of all traffic in the net.
5. Regulate the speed of all data transmissions.
6. Resolve disputes regarding traffic handling and net procedure.
7. Monitor net operations and take appropriate action to correct procedural discrepancies.
8. Conduct training discussions in radio procedures.

B. Responsibility and Authority of ANCS

To insure continuity of control, an ANCS will be appointed. The ANCS will exercise all the responsibilities and authority of the NCS whenever the NCS is unavailable. The ANCS will aid the NCS in the operation of the net with respect to:

1. Reporting any errors or omissions in the call-up or traffic reports.
2. Acting as a relay station.
3. Noting inaccurate net procedures.
4. Aiding the NCS in procedural training discussions. In the absence of both the NCS and ANCS, any station in the net may act as interim NCS. If the NCS or ANCS is not heard by one (1) minute past the opening net time, the first station to call will assume control of the net until relieved by the regularly assigned NCS or ANCS.

1-2 TYPES OF NETS.

A. Directed Net. A directed net is one in which it is necessary to obtain permission from the NCS before transmitting to other stations on the net. USACE nets will be directed, unless otherwise indicated, by the NCS. Only those stations which are assigned may enter a directed net without first obtaining permission from NCS. Stations not assigned to a specific directed net must call the net NCS for permission to operate in that net.

B. Free Net. When operating conditions permit, the NCS may direct that the net be operated as a free net. Member stations are therefore authorized to transmit traffic to other net stations without obtaining prior permission from the NCS. Free net operation does not relieve the NCS of the authority and responsibility for circuit discipline.

C. Open Net. An open net will be declared only after all traffic has been cleared and all training has been conducted. An open net declares the net open to any USACE station, whether they are division or district.

1-3 RADIO STATION LOG.

A. A Radio station log (DA Form 4341) will be maintained by all stations to record operational information. The Station log will contain the following information:

1. Time of opening and closing of the station or net.
2. Call signs of stations worked.
3. Causes of delay on the circuit or net.
4. Unusual occurrences.
5. Number of messages sent and received.

B. Radio station logs will be retained for one (1) year following the last entry date.

C. At the end of each FY quarter district stations will use their logs to summarize their activity including hours operated and messages handled. These reports will be submitted to their respective division. Each division will use the accumulated data to furnish a consolidated report to CELMVD not later than 15 days after the end of the FY quarter. This information will be used to evaluate the radio system effectiveness and determine training or organization needs.

Reports will be made in message form and transmitted to CELMVD via radio. If unable to do this, the report is to be mailed to U.S. Army Corps of Engineers, P.O. Box 60, Vicksburg, MS 39180 ATTN: CELMK-IM-ICR.

1-4. AUTHENTICATION PROCEDURE AND SYSTEM

A. Authentication systems are used to maintain and protect the reliability of military communication systems by preventing the introduction of fraudulent messages or signals intended to cause erroneous actions, damage, confusion, or disclosure of important information.

B. In actual practice, authentication systems are appropriately classified and safeguarded in order to prevent disclosure to unauthorized individuals. Security of authentication systems is enhanced by random selection of test elements each time authentication is employed.

C. Instructions concerning the method of selection and application of elements in authentication systems will not be discussed on the air. Such instructions will accompany the authentication publication. On the air instructions will include only general information indicated by appropriate operating signals, such as requirement for authentication.

1. Within the Corps of Engineers, the authentication table employed to establish the authenticity of a communications station is classified, unless otherwise established by the NCS..

a. Station Authentication. Authentication is employed between stations to guarantee their authenticity. Station authentication is used under the following circumstances:

- (1) Whenever fraudulent transmission or operation is suspected in a radio net.
- (2) When instructions are issued to change radio frequency and when initial contact is made after such change.
- (3) When directed by the NCS.
- (4) Test elements of authentication, in the form of a challenge, are transmitted after the call as follows: Authenticate (2 letters) Over"?

Reply -" Authentication is (1 letter) Over."

b. An unclassified practice authentication table and instructions follow.

S	R	P	O	M	Q	N	J	L	K	G	I	H	F	E	D	A	Z	B	Y	C	X	V	W	U	T
T	Z	W	Y	X	U	P	S	D	R	Q	M	O	N	L	K	J	G	H	I	A	C	B	F	E	V
U	Z	V	Y	W	X	T	Q	S	R	M	O	N	J	L	K	G	I	H	F	D	E	C	A	B	K
V	C	B	F	E	D	I	H	G	J	L	K	O	M	N	R	P	Q	U	V	W	X	Y	Z	A	S
W	X	V	Y	T	U	Z	R	T	S	O	P	Q	L	N	M	I	K	J	F	H	G	C	E	D	B
X	C	B	A	F	E	D	I	H	G	L	K	J	M	O	N	Q	P	R	U	T	S	Z	W	Y	X
Y	X	Z	W	S	U	T	Q	R	P	M	N	O	J	K	L	G	H	I	D	F	E	C	B	A	V
Z	G	F	E	C	D	B	A	J	I	H	M	L	K	P	O	N	S	Q	R	V	U	Y	X	W	T

Use of the above authentication table:

When asked to authenticate any two letters:

- (1) Go down left hand column of letters to the first letter asked for.
- (2) Go directly across page from the first letter to the second letter asked for.

(3) Give authentication, as the next letter in the line.

Example: To authenticate for WL, the authentication is N.

To authenticate for SX, the authentication is V.

If the second letter is the last letter in the line use the second letter in the same line as authentication.

Example: The authentication for ZT is G.

1-5 HANDLING DISTRESS CALLS.

A. An operator who hears a distress call from a station should answer the call promptly and take whatever steps necessary to give assistance.

Operators not located close to the sources of immediate relief should continue to monitor.

Whether he answers or not, every operator bearing a distress call or monitoring distress traffic should copy everything and retain the copy in his log, including calls of stations answering the call and handling the traffic.

B. Generally, once a distress call has been answered by a station which is in a position to send aid, other radio operators should continue monitoring, and stand ready to assist if needed.

C. A station which answers a distress call and handles the distress message should try to maintain radio contact with the station in trouble as long as possible. He should try to keep the distressed station advised as to progress of relief measures and should be ready to handle any further traffic which might originate with the distressed station. At this stage of the situation, traffic originated by the station in distress has absolute precedence over all other traffic. While rescue or relief is actually in progress, only communications of IMMEDIATE precedence should be handled whether or not a directed net has been established. PRIORITY traffic will be held until the immediate danger to human life or safety has been cleared up.

D. If an emergency net has been set up to handle distress communications, the station in distress clearly has priority for traffic handling over other stations that may be in the net.

2.0 MESSAGES

2-1 GENERAL

2-2 ORIGINATOR'S AUTHORITY AND RESPONSIBILITY.

A. The originator of a message is the person or command by whose authority a message is sent and who determines what to say and to whom.

B. The originator is responsible for:

1. Determining the necessity for radio transmission.
2. Determining the proper precedence of the message.
3. Drafting the message properly. I.E. keeping the message brief, by the use of short concise statements. etc.

C. It takes careful thought to originate a good message. What may seem simple and appropriate to the originator may be interpreted in an entirely different light by the addressee if proper care is not exercised. Vague and ambiguous text can be misinterpreted resulting in an exchange of additional explanatory messages.

D. The originator will eliminate all words not necessary to convey the internal meaning. Commonly used conjunctions, prepositions, and articles such as and, but, for, in, on, and, the can be eliminated unless essential to the meaning. Words such as please, thank you, appreciate action and regards, have no place in official traffic. Length of messages can be further shortened by intelligent use of the abbreviations in common usage.

E. Repetition will not be used solely for the purpose of emphasis.

2-3 PRECEDENCE

The precedence of a message is determined by the subject matter and time factor involved and assigned by the originator. Messages will not be assigned a precedence higher than is required to insure timely delivery to the addressee(s).

A. To the communicator, the precedence assigned a message indicates the relative order in which the message should be handled.

B. Dual precedence may be assigned to multiple-address messages having both action and information addressees. One precedence is used for the action addressee and a lower precedence for all information addressees.

C. Precedence designations (definitions and order of handling):

1. Routine (R) All types of messages which are not of sufficient urgency to justify a higher precedence, but must be delivered to addressee without delay. Routine messages are processed, transmitted and delivered in the order received and after all messages of higher precedence. Messages handled for practice on weekly USACE radio nets will be assigned a routine precedence.

2. Priority (P) Important messages which must have precedence over routine traffic. Priority messages are transmitted ahead of all routine messages.

3. Immediate (O) Messages of urgent nature that take priority over Priority messages.

4. Flash (Z) is the highest priority of all messages and is handled without delay over all other messages.

2-4 MESSAGE PREPARATION.

A. All messages must contain:

1. Heading which includes:

- a. Message number
- b. Precedence
- c. Date time group
- d. Addressees and identity of sender (from)
- e. Group count if applicable.

2. Text

3. Ending

- a. Signature if applicable
- b. Operating instructions.

2-5 PHONETIC ALPHABET.

<u>LETTER</u>	<u>WORD</u>	<u>PRONUNCIATION</u>
A	ALFA	<u>AL</u> FAH
B	BRAVO	<u>BRAH</u> VOH
C	CHARLIE	<u>CHAR</u> LEE
D	DELTA	<u>DELL</u> TAH
E	ECHO	<u>ECK</u> OH
F	FOXTROT	<u>FOKS</u> TROT
G	GOLF	GOLF
H	HOTEL	HOH <u>TELL</u>
I	INDIA	<u>IN</u> DEE AH
J	JULIETT	<u>JEW</u> LEE <u>ETT</u>
K	KILO	<u>KEY</u> LOH
L	LIMA	<u>LEE</u> MAH
M	MIKE	MIKE
N	NOVEMBER	NO <u>VEM</u> BER
O	OSCAR	<u>OSS</u> CAH
P	PAPA	PAH <u>PAH</u>
Q	QUEBEC	KEY <u>BECK</u>
R	ROMEO	<u>ROW</u> ME OH
S	SIERRA	SEE <u>AIR</u> RAH
T	TANGO	<u>TANG</u> GO
U	UNIFORM	<u>YOU</u> NEE FORM
V	VICTOR	<u>VIK</u> TAH
W	WHISKEY	<u>WISS</u> KEY
X	X-RAY	<u>ECKS</u> RAY
Y	YANKEE	<u>YANG</u> KEY
Z	ZULU	<u>ZOO</u> LOO

(THE UNDERLINED PORTION DENOTES THE ACCENTED SYLLABLE (S)).

2-6 PRONUNCIATION OF NUMBERS

<u>NUMBER</u>	<u>PRONUNCIATION</u>
0	<u>ZEE</u> ROO
1	WUN
2	TOO
3	THUH <u>REE</u>
4	<u>FO</u> WER
5	<u>FI</u> YIV
6	SIX
7	<u>SE</u> VEN
8	ATE
9	<u>NIN</u> ER *

*Note: This number is the only one of the above that is pronounced uniquely.

2-7 PUNCTUATION

Punctuation is not used in voice operations unless essential to the sense of the message.

2-8 NUMBERS AND PHONETICS.

Use of numbers: Numbers may be written as digits or spelled out. When spelled out they are expressed in words for each digit except hundreds or thousands when the word hundred or thousand is used. For example, 246.8 is written two four six pt eight and is unmistakable, but two forty six pt eight could be interpreted to mean 2406.8. The figure 1500 would be written one five hundred. Roman numerals will be preceded by the word Roman to avoid misunderstanding.

2-9 EXAMPLES OF MESSAGE FORMATS

A single address message would be written as follows:

msg nr. precedence date time group

Nr. 1 ROUTINE 051700Z April 88

FROM: COMMANDER, (originator) LOWER MISS. RIVER DIVISION

TO: COMMANDER, (addressee) SOUTH ATLANTIC DIVISION

GR 5 (group count)

BT

(Break)

(text) APPROVAL GRANTED FREQUENCY CHANGE DISCUSSED.

BT

(Break)

The message above would be transmitted via radiotelephone as follows:

Whiskey uniform charlie this is whiskey uniform golf message follows

Number one routine time zero five one seven hundred zulu April 88

From Commander Lower Mississippi Valley Division

To Commander South Atlantic Division

Groups five Break

Approval granted frequency change discussed

Break

Over

A multiple address message would be basically the same as the above except in the TO line all addressees would be listed.

2.10 GROUP COUNT INSTRUCTIONS:

All normal form messages will include a group count and will be assigned at the point of origin.

- A. Count text groups including the signature only.
- B. Punctuation and symbols are not counted unless spelled out or abbreviated.
- C. A sequence of characters not interrupted by a space is counted as one group.
- D. The letter "X" when used in lieu of punctuation is counted as one group. (The letter "X" will not be used in lieu of punctuation in messages originated by Corps Of Engineers stations. Other originating stations may use this type of punctuation count)
- E. The proper names of countries, states, cities or streets consisting of two or more separate words will be written and transmitted as one word, I.E. Sansalvador, Northcarolina, Newyorkcity. Southmainstreet.
- F. If you don't count the groups in a message you transmit, show groups not counted (GRNC).

3.0 RADIOTELEPHONE PROCEDURES

3-1 GENERAL

A. This chapter contains specific instructions for the conduct of communications employing radiotelephone. Adherence to prescribed procedure is MANDATORY.

B. Reliability is the paramount consideration in military communications. In speaking, natural phrases, not word by word pronunciation should be used, except when using the prescribed pronunciation of numerals and phonetic letters. Natural emphasis should be placed on each word.

1. Operators will transmit messages exactly as written. Prowords, operating signals or abbreviations will not be substituted for text words or groups as written by the originator.

2. An operator who receipts for a message should be certain that he has the message exactly as transmitted. He is then responsible for timely delivery or relay of the message.

3. In net operation, the speed of the slowest operator will normally govern the speed of all stations on the net.

4. Operators transmitting a message will transmit at a speed no greater than specified by the NCS.

5. NCS may suspend this rule when situations require faster transmission to individual stations.

3-2 PROWORDS, OPERATING SIGNALS AND PHONETICS.

A. Prowords. Prowords are pronounceable words or phrases which have been assigned meanings for the purpose of expediting message handling on circuits where radiotelephone procedure is employed. A list of authorized prowords and their meanings are contained in appendix A.

B. Operating Signals. Operating signals Q and Z are not designed for radiotelephone transmissions. They are employed when using CW (Morse Code). If it should become necessary to relay operating signals over a radiotelephone circuit, they will be expressed phonetically.

C. Phonetic Alphabet. When it becomes necessary to spell difficult words or groups or to identify a letter of the alphabet, the standard phonetic alphabet will be used. The word or group to be

spelled will be preceded by the proword, "I Spell". If the operator can pronounce the word to be spelled he will do so before and after the spelling to identify the word.

1. Encrypted or enciphered groups, even though occasionally pronounceable will always be transmitted by the phonetic alphabet.

2. A single letter will be identified phonetically preceded by the proword "Initial."

3. The phonetic alphabet is contained in the message preparation chapter of this document. All operators should be thoroughly familiar with this alphabet prior to operating on any net.

4. Pronunciation of numerals. In order to distinguish between numerals and words similarly pronounced the proword "Figure (s)" shall be used. Numbers will be transmitted digit by digit rather than collectively.

3-3. CALLING.

A. The preliminary call transmitted to establish communications may be a single, net, or multiple call as outlined below. When net calls are used the proword "Exempt" may be used to exclude stations for whom no radio traffic is addressed, etc. Under difficult reception conditions call signs may be transmitted twice. Two or more call signs transmitted as part of the call or appearing in message addresses will normally be arranged in numerical or alphabetical order.

1. A single call consists of the call sign of the station called, the proword "This Is" and the call sign of calling station, and the proword "Over".

Example: "WUO this is WUG, Over".

2. Multiple calls consist of the call signs of two or more stations and the proword "This Is" and the call sign of the calling station and the proword "Over".

Example: "WUC WUD this is WUO, Over".

3. Net calls will be used by the net control station to simplify calling procedures and eliminate the necessity of calling each station in the net individually. The net call sign is identified by having a slant bar and a single letter included in the NCS call sign.

Example: "WUH/B this is WUH, Over".

B. At this point each district in CEMRD will check into the net by transmitting "WUH This is (Your call sign) no traffic (or list traffic) over". This call represents all the stations assigned to the

net. Stations should answer in alphabetical order. Each division will use a net call with a slant bar and letter "B" after their call sign for their net with their districts. WUG or their alternate (WUH) will use net call sign with a slant bar and the letter "A" for the net with the divisions in CONUS.

Example of net call with exempted station: "WUG/A exempt WUC, this is WUG, Over".

At this point each division will check into the net by transmitting "WUG this is (Your call sign) No Traffic" or list traffic, such as "one routine for WUJ Over".

C. If any station fails to answer in proper sequence when a net or multiple call is employed the next station waits 5 seconds and answers. The station which fails to answer in proper order must wait until all other stations have answered or have had time to answer.

D. When a station hears a call without being certain who the call is intended for, the station shall not answer until the call has been repeated and understood. If the operator recognizes that someone is calling his station but their call sign was not understood, he/she may transmit as follows: "Unknown station - this is (your call sign) Over".

3-4. TRANSMISSION ENDINGS

A. Proword "Over" is used when an answer is requested or expected.

B. Proword "Out" is used when an answer is not requested or expected.

C. Every transmission will end with either "Over" or "Out". No other ending is permissible. e.g. "Go", "Go ahead", "Back to you", etc will not be used in the USACE communications.

D. The prowords "Over" and "Out" are never used together at the end of any transmission.

4.0. SIGNAL STRENGTH AND READABILITY.

- A.** A station assumes it has a readability of good, unless otherwise notified. Signal strength and readability reports will not be exchanged unless communication is unsatisfactory.
- B.** Readability is a measure of the ease with which the incoming signals can be understood. This depends on the relative strength and quality of the signal.
- C.** A station wishing to inform another of this signal strength and readability will do so by means of a short, concise report of actual reception such as, "Weak but Readable", "Strong but Distorted", or "Loud and Clear". Reports such as "Five by Five" and "Four by Four" will not be used to indicate strength and quality of reception.

5.0 DESCRIPTION OF HIGH FREQUENCY CHARACTERISTICS AND UTILIZATION

5-1 THE HF SPECTRUM.

Communications in the long range radiotelephone service must be conducted over distances of up to 2,000 or more miles. The high frequency (HF) spectrum 3,000 to 30,000 KiloHertz (KHz) fulfills the long range requirement and therefore is used for this purpose.

5-2 CHARACTERISTICS OF HF PROPAGATION.

The propagation of transmissions on frequencies within the HF spectrum covers great distances by virtue of the fact that the radiations travel outward and upward from the antenna until striking layers of the upper atmosphere called the ionosphere, located 30 to 300 miles above the earth. Upon encountering the ionosphere, the radiations are reflected and/or refracted back to earth at distances of hundreds or even thousands of miles from the transmitter. Under certain conditions the radiation may be reflected back to the sky, where it is again refracted back to earth, where it is again reflected back to the ionosphere, and so on where extreme distances are reached before the radiation becomes completely dissipated. This reflective effect is frequently referred to as "skipping".

5-3 SKIP DISTANCE EFFECT AND VARIATION WITHIN THE HF SPECTRUM.

From the above description of the radiation properties of frequencies in the HF spectrum, it can be seen that, for example, one station 100 miles distant from a ground station may receive nothing on a particular frequency, while another station 1000 miles distant may receive the same transmission clearly.

The skip distance factor of a frequency in one part of the HF spectrum is different from that of a frequency in another part of the spectrum that is, there will usually be a group of frequencies in a particular part of the spectrum which will provide adequate contact between two stations under a particular set of conditions.

Example: Distance - 500 miles; time - night; season - winter. A change in any one of these conditions may necessitate the use of a different frequency within the HF spectrum for optimum contact.

5-4 STATIC AND FADING

In addition to the skip distance variables described above, transmissions of frequencies within the HF spectrum are affected by static electrical disturbances caused by lightning and static discharges in the atmosphere which interfere with clear reception of HF transmissions. Another form of static is man-made noises resulting from electrical discharge from devices such as electric motors, gasoline engine ignition systems, fluorescent lights, arcing insulators on electric power lines or other electrical discharges (sparking) in the vicinity of receiving antennas. This type of interference is more pronounced on the high frequencies of the HF spectrum.

Fading is evident in HF Communications when the received signal strength diminishes and increases in an intermittent manner.

5-5 OPERATING SKILL IN FREQUENCY UTILIZATION

The proficiency of a station operator is largely dependent on his knowledge of the characteristics of communications utilizing frequencies in the HF spectrum and his ability to overcome adverse receiving conditions through selection of the optimum frequency, proper adjustment of receiver controls and skill in accurately receiving the intelligence of a transmission affected by interference, weak signals, static, fading, etc.

APPENDIX A

PROWORDS AND THEIR MEANING.

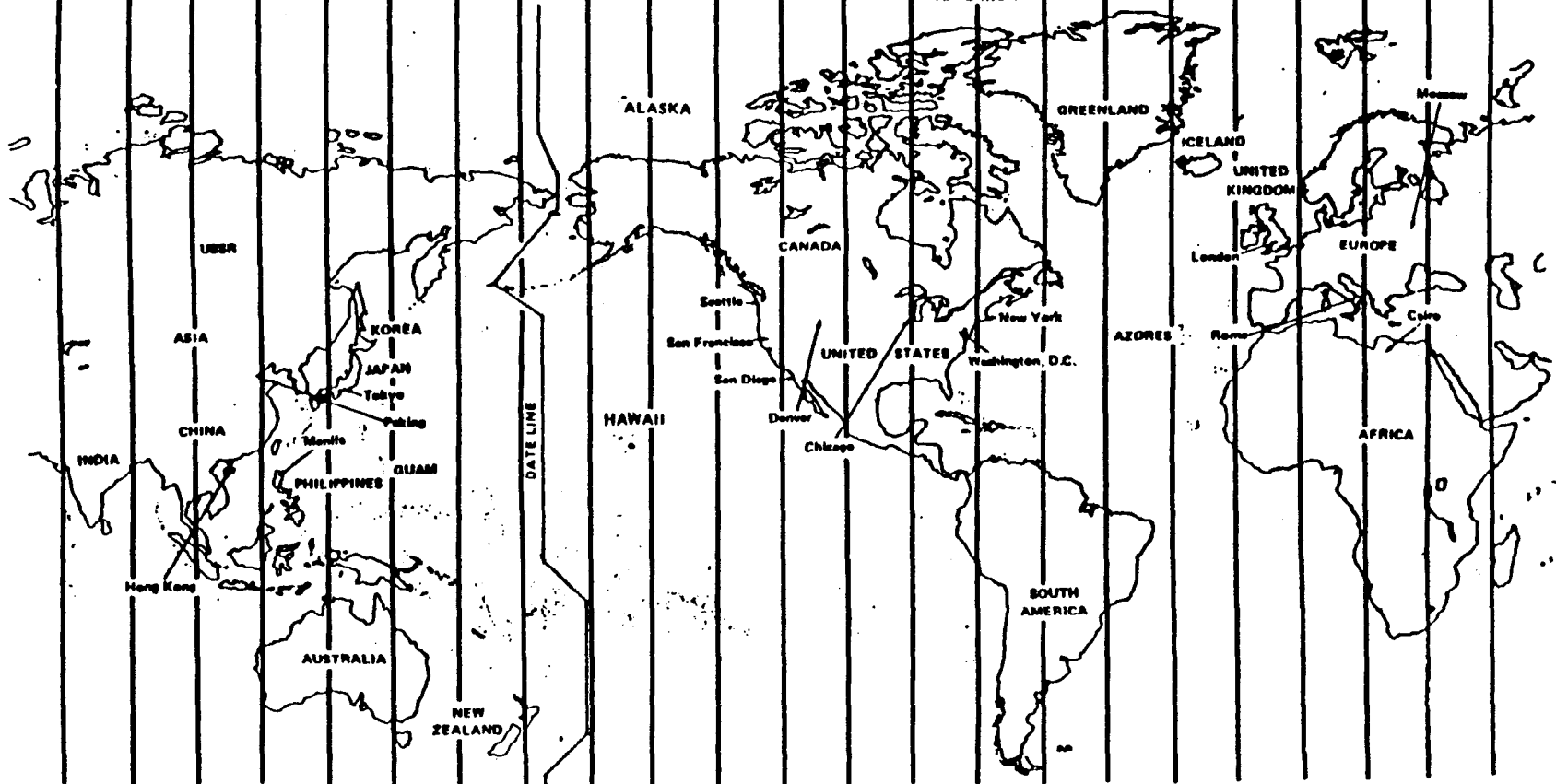
Prowords are pronounceable words or phrases which have been assigned meanings for the purpose of expediting message handling on circuits where radiotelephone procedures are employed. In no case, shall a proword or combination of prowords be substituted for textual components of a message. Typical prowords which may be used on the USACE HF Radio Net include:

<u>PROWORD</u>	<u>MEANING</u>
Unknown station	Unknown station
All after	All after
All before	All before
Out	End of transmission
Wait	I must pause for a few seconds
Wait Out	I must pause longer than a few seconds, will call you back.
More to follow	More to follow
Break	Break
Correct	Correct
This is	From
Time	That which immediately follows is the time or date time group of this message.
Correction	Error
Disregard	Sent in error, disregard
Do not answer	Do not answer
From	Originator
Read back	Repeat this entire transmission back to me.
Groups	Group count

Groups not counted	The groups in this message have not been counted.
Silence	Emergency silence
Silence lifted	Resume normal transmissions (silence once imposed, can only be lifted by the stations imposing it, or higher authority)
Say again	Repeat
I spell	I shall spell the next word (s) phonetically.
Words twice	Communications is difficult, transmit each phrase twice.
Execute to follow	Action on the message which follows is to be carried out upon receipt of "Execute".
Execute	Carry out now
Verify	Verify with originator and repeat.
Over	Go ahead, or this is the end of my transmission to you and a response is necessary.
Message follows	Message requiring copying follows.
Figures	Numerals or numbers follow
Immediate	Immediate precedence (signified by (O))
Priority	Priority precedence (signified by (P))
Roger	I have received your last transmission satisfactorily
Routine	Routine precedence (signified by (R))
Word after	Word after
Word before	Word before.

TIME ZONE CHART

E	F	G	H	I	K	L	MY	X	W	V	U	T	S	R	Q	P	O	N	Z	A	B	C	D
1800	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800
2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900
2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100
2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400
0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100
0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200
0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300
0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400
0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500
0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600
0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700
0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800
1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900
1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000
1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300
1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400
1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500
1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600
1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700



APPENDIX B

MILITARY TIME

STANDARD TIME

MILITARY TIME

6 A.M.	0600	0 six hundred
7 A.M.	0700	
8 A.M.	0800	
9 A.M.	0900	
10 A.M.	1000	ten hundred
11 A.M.	1100	
12 A.M.	1200	
1 P.M.	1300	
2 P.M.	1400	
3 P.M.	1500	
4 P.M.	1600	
5 P.M.	1700	
6 P.M.	1800	
7 P.M.	1900	
8 P.M.	2000	
9 P.M.	2100	
10 P.M.	2200	
11 P.M.	2300	
12 Mid	2400	
1 A.M.	0100	
2 A.M.	0200	
3 A.M.	0300	
4 A.M.	0400	
5 A.M.	0500	

APPENDIX C

The following is a list of division/district call signs, phone number, FTS, name of radio operator, FAX number, and status of their KL-43 at each location:

SITE	REG CALL	ARQ CALL	PHONE NUMBER	OPERATOR
HQUSACE	WUO	WWUO	202-475-9179 9068	OSCAR ANDERSON MAJ. DOUGLAS
CELMV VICKSBURG	WUG	WWUG FTS	601-631-7401 LMV 495-7401 LMK 495-7401	DALE CHANCEY DAVID GARRICK DOT HARTZOG
MEMPHIS	WUG-2	WUGB FTS	901-544-3571 222-3571	BILLY BROOKS SAM ROBINSON
NEW ORLEANS	WUG-4	WUGD FTS	504-862-1900 493-1900	VAC T NGUYEN
ST. LOUIS	WUG-5	WUGE FTS	314-331-8700 262-8650	JOHN BAKER ROGER SILLER
VICKSBURG	WUG-3	WUGC	601-631-7401	SAME AS CELMVD
CEMRD OMAHA	WUH	WWUH FTS	402-221-3040 MRD 864-3040	BILL LEATHERWOOD FRANK TAYLOR
KANSAS CITY	WUH-5	WUHE FTS	816-426-3074 867-3074	ROB BRANNON
CENAD NEW YORK	WUB	WWUB FTS	212-264-7091 264-3373	STEVE MONTE (EM) JAFFRE (IMO)
BALTIMORE	WUB-4	WUBD FTS	301-962-4223 922-4223	
NEW YORK	WUB-2	WUBB FTS	212-264-0162 264-0162	FRANK PORCARO
NORKFOLK	WUB-5	WUBE FTS	804-441-7631 931-7631	GLEN SEAY
PHILADELPHIA	WUB-3	WUBC FTS	215-597-0703 597-0703	
CENED WALTHAM	WUA	WWUA FTS	617-647-8270 8393 839-8270	JERRY ROFFEY RACHEL WRIGHT
CENCD CHICAGO	WUD	WWUD FTS	312-353-5785 886-8451	TIM MONTEEN RANDY SMITH
BUFFALO	WUD-2	WUDB FTS	473-	
CHICAGO	WUD-4	WUDD	312-353-5785	RANDY SMITH (DIST)

DETROIT	WUD-3	FTS	886-5785	
		WUDC	313-226-6801	
		FTS	226-6801	
ROCK ISLAND	WUD-7	WUDG	319-788-6361	
		FTS	753-6361	
ST. PAUL	WUD-6	WUDF	612-437-2210	RICH
		FTS	333-2210	
CENPD				
PORTLAND	WUJ	WWUJ	503-326-7311	JOHN CAVAGROTTI
		FTS	423-3761	
ANCHORAGE	WUJ-5	WUJE	907-753-2513	
PORTLAND	WUJ-3	WUJC	503-326-2430	SAM PREECE
		FTS	423-2430	JOHN CAVAGROTTI
SEATTLE	WUJ-2	WUJB	206-764-3761	MAHLON GOOD
		FTS	446-3761	
WALLA WALLA	WUJ-4	WUJD	509-522-6935	
		FTS	434-6935	
CEORD				
CINCINNATI	WUE	WWUE	513-684-6569	ED MINOR (IMO)
		FTS	684-3088	FRANK JONES (EOC)
HUNTINGTON	WUE-4	WUED	304-529-5133	JERRY DAVIS
		FTS	924-5133	LINDA CHAFIN
LOUISVILLE	WUE-5	WUEE	502-582-5644	
		FTS	352-5644	
NASHVILLE	WUE-6	WUEF	615-824-1032	ROSA SWANNER
		FTS	852-1032	GEORGE GROGAN
PITTSBURGH	WUE-3	WUEC	412-644-6892	
		FTS	722-6892	
CEPOD				
FT. SHAFTER			808-438-1331	
		FTS	551-1331	
CESAD				
ATLANTA	WUC	WWUC	404-331-5252	GLENN DECKELMAN
		FTS	841-5252	
CHARLESTON	WUC-3	WUCC	803-724-4205	SHELDON REED
		FTS	677-4675	
JACKSONVILLE	WUC-5	WUCE	904-791-1756	BOB JOURA/NICK
		FTS	946-1756	
MOBILE	WUC-6	WUCF	205-690-2489	DEWEY HARRIS
		FTS	537-2489	
SAVANNAH	WUC-4	WUCD	912-944-5431	STACY AARON
		FTS	248-5431	
WILMINGTON	WUC-2	WUCB	919-251-4856	DIANE LANSINGER
		FYS	232-4856	
CESPD				
SAN FRANCISCO	WUK	WWUK	415-744-1406	JERRY LOLLAR
		FTS	484-1406	ROBERT SELBY
LOS ANGELES	WUK-4	WUKD	213-894-5522	
		FTS	798-5522	
SACRAMENTO	WUK-3	WUKC	916-551-3121	
		FTS	460-3121	
SAN FRANCISCO	WUK-2	WUKB	415-744-3403	HELGA GRAHL
		FTS	484-3403	

DALLAS	WUI	WWUI	214-767-5302	STEVE BARKER
		FTS	729-5302	
ALBUQUERQUE	WUI-5	WUIE	505-766-1729	LUCILLE GALLEGOS
		FTS	474-1729	
FORTH WORTH	WUI-6	WUIF	817-885-4146	
			2267	
		FTS	334-4146	
GALVESTON	WUI-4	WUID	409-766-6308	
		FTS	527-6308	
LITTLE ROCK	WUI-2	WUIB	501-324-5878	CHARLES WALTERS
		FTS	740-5878	
TULSA	WUI-3	WUIC	918-581-7282	JOHN CROTTS
		FTS	754-7282	

COE LABS:

OFFICE SYMBOL	LOCATION	COMM'L PHONE	FTS
CEASA	FT. BELVOIR, VA	202-653-5100	
CEBRH	FT. BELVOIR, VA	202-355-2453	
CECER	CHAMPAIGN, IL	217-352-6511	
CECRL	HANOVER, NH	603-645-4100	
CEERB	VICKSBURG, MS	601-636-3111	542-3111
CEESC	FT. BELVOIR, VA	202-355-2373	
CEETL	FT. BELVOIR, VA	202-355-2600	
CEHEC	FT. BELVOIR, VA	202-355-2220	
CEHSC	FT. BELVOIR, VA	202-355-2300	
CEMRC	VICKSBURG, MS	601-634-5000	790-5000
CEWES	VICKSBURG, MS	601-634-4012	542-4012
	FAX	634-3804	
CEWRC	FT. BELVOIR, VA	202-355-2252	345-2250
CEWRC-IWR	FT. BELVOIR, VA	202-355-2016	
CEWRC-NAC-C	NEW ORLEANS, LA	504-862-1404	493-1404

FAX NUMBERS

HQ/DIV/CRS

WUO	HQUSACE	WASHINGTON, DC	202-475-9079	MAJ DOUGLAS
WUH	CEMRD,	OMAHA, NE	402-221-3029/3030	BILL
		FTS	864-3029	LEATHERWOOD
WUG	CELMV,	VICKSBURG, MS	601-631-7400	DALE CHANCEY
WUE-4	(CRS)	HUNTINGTON, WV	304-529-5591	FREDDIE PYLES
WUE	CEORD	CINCINATTI	513-684-3800	ED MINOR
		FTS	684-3844	(EOC)
WUA	CENED,	WALTHAM, MA	617-647-8378	RACHEL WRIGHT
		FTS	839-8378	
WUK	CESPD	SAN FRANCISCO, CA	415-744-3320	JERRY LOLLAR
		FTS	484-3320	
WUB	CENAD	NEW YORK, NY	212-264-5213	STEVE MONTE
WUD	CENCD	CHICAGO, IL	312-353-4997	TIM MONTEEN
		FTS	886-4997	
WUJ	CENPD	PORTLAND, OR	503-326-4105	JOHN CAVAGROTTI
		FTS	423-4105	(NON-SECURE)
			503-326-5286	(SECURE)
		FTS	423-5286	
WUC	CESAD	ATLANTA, GA	404-331-2814	BRYON GOLDMAN
		FTS	841-2814	
WUI	CESWD	DALLAS, TX	214-767-2340	STEVE BARKER

WUI-5 (CRS)	ALBUQUERQUE, NM	FTS 729-2340 505-766-8757 FTS 474-8757	LUCILLE GALLEGOS
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DIST.

WUE-4	CEORH	HUNTINGTON, WV	304-529-5086 FTS 924-5086	JERRY DAVIS
WUG-2	CELMV	MEMPHIS, TN	901-544-3337	BILLY BROOKS
WUG-3	CELMV	VICKSBURG, MS	601-631- FTS 222-3337	
WUG-4	CELMV	NEW ORLEANS, LA	504-862-1091 FTS 493-1091	VAC T. NGUYEN
WUG-5	CELMV	ST. LOUIS, MO	314-331-5324 FTS 262-5324	JOHN BAKER
WUH-5	CELMRK	KANSAS CITY, KA	816-426-2730 FTS 867-2730	ROB BRANNON
WUI-2	CESWD	LITTLE ROCK, AR	501-324-6968 FTS 740-6968	CHARLES WALTERS
WUI-3	CESWT	TULSA, OK	918-581-7291 FTS 745-7291	JANICE COY
WUI-4	CESWG	GALVESTON, TX	409-766-6905 FTS 527-6905	LOUIS PETITE
WUI-5	CESWA	ALBUERQUE, NM	505-766-8757 FTS 474-8757	LUCILLE GALLEGOS
WUI-6	CESWF	FT WORTH, TX	817-885-4525 FTS 334-4525	JERRY NEAL
WUJ-3	CENPP	PORTLAND, OR	503-326-5548 FTS 423-5548 EOC FAX 503-326-6993 FTS 423-6993 EOC SECURE VOICE 503-326-6888 FTS 423-6888	SAM PREECE

STATUS OF PK-232 AND KL-43

SITE/DIV/CRS	CL SIGN	PK 232	KL-43 AND MATERIAL
PORTLAND	WUJ	OPERATIONAL	UP-TO-DATE
DALLAS	WUI	OPERATIONAL	EFFECTIVE SUBSTITUTE
OMAHA	WUH	OPERATIONAL	UP-TO-DATE
WALTHAM	WUA	NON-OPERATIONAL	UP-TO-DATE
HUNTINGTON	WUE-4 (CRS)	OPERATIONAL	UP-TO-DATE
ATLANTA	WUC	NON-OPERATIONAL	UP-TO-DATE
VICKSBURG	WUG	OPERATIONAL	UP-TO-DATE
NEW YORK	WUB	NON-OPERATIONAL	SECURE FAX
CHICAGO	WUD	NON-OPERATIONAL	UP-TO-DATE
CINCINNATI	WUE	NON-OPERATIONAL	UP-TO-DATE
SAN FRANCISCO	WUK	NON-OPERATIONAL	UP-TO-DATE
ALBUQUERQUE	WUI (CRS)	OPERATIONAL	UP-TO-DATE

SITE/DIST			
CHICAGO	WUD-4	NON OPERATIONAL	UP-TO-DATE
NASHVILLE	WUE-6	OPERATIONAL	UP-TO-DATE
MEMPHIS	WUG-2	OPERATIONAL	UP-TO-DATE
VICKSBURG	WUG-3	OPERATIONAL	UP-TO-DATE
NEW ORLEANS	WUG-4	OPERATIONAL	UP-TO-DATE
ST. LOUIS	WUG-5	NO REPORT	UP-TO-DATE
KANSAS CITY	WUH-5	OPERATIONAL	UP-TO-DATE
SEATTLE	WUJ-2	OPERATIONAL	UP-TO-DATE
LITTLE ROCK	WUI-2	DO NOT HAVE	UP-TO-DATE
SAN FRANCISCO	WUK-2	DO NOT HAVE	UP-TO-DATE

SITE/LAB

WES/VICKSBURG	WUP	OPERATIONAL	UP-TO-DATE
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NOTE: IN RESPONSE TO THE REQUESTED INFORMATION, THIS IS THE UPDATED INFORMATION THAT WAS RECEIVED AT THIS STATION. PLEASE REVIEW AND NOTE ANY CORRECTIONS AND FORWARD TO WUG, LMVD.

APPENDIX D

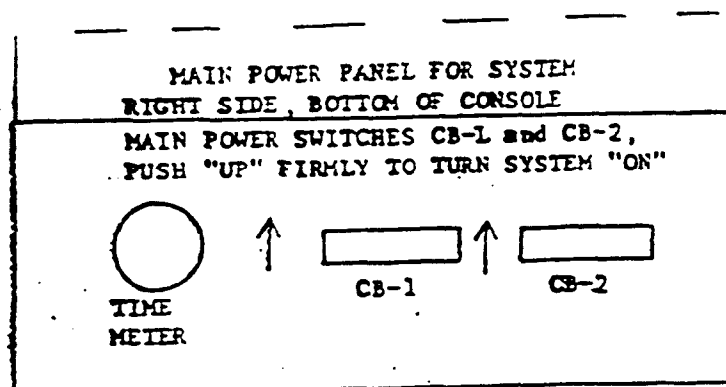
LONGITUDE/LATITUDE FOR DIVISION/DISTRICTS

<u>DIV/DIST</u>	<u>LATITUDE</u>	<u>LONGITUDE</u>
Lower Mississippi Valley	32.2117N	090.5416W
Memphis	35.0410N	090.0726W
New Orleans	29.5610N	090.0805W
St. Louis	38.3000N	090.2400W
Vicksburg	32.2117N	090.5416W
Missouri River	41.2200N	095.5800W
Kansas City	39.1500N	094.3500W
Omaha	41.2200N	095.5800W
New England	42.2400N	071.1300W
North Atlantic	40.4106N	074.0418W
Baltimore	39.1500N	076.3100W
New York	40.4106N	074.0418W
Norfolk	36.5500N	076.1500W
Philadelphia	36.5700N	075.0900W
North Central	41.3400N	088.0200W
Buffalo	42.5600N	078.5410W
Chicago	41.5247N	087.3748W
Detroit	42.1900N	083.0000W
Rock Island	41.3103N	092.3349W
St. Paul	45.0000N	093.1000W
North Pacific	45.4648N	122.5130W
Alaska	61.1000N	149.5500W
Portland	45.4648N	122.5130W
Seattle	47.3303N	119.3203W

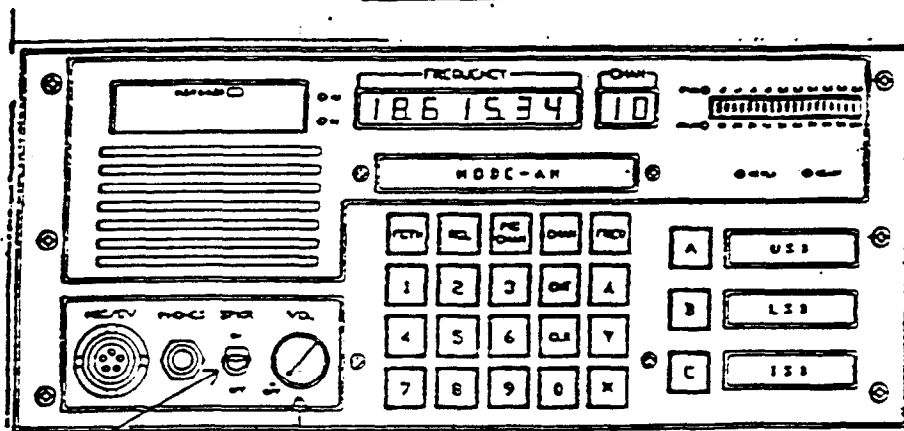
Walla Walla	46.0520N	118.2230W
HQUSACE	38.5300N	077.0100W
Ohio River	39.0358N	084.2627W
Huntington	38.2153N	082.2805W
Louisville	38.4551N	085.4543W
Nashville	36.1743N	086.3932W
Pittsburgh	40.2952N	0800.0070W
Pacific Ocean	21.2043N	157.0330W
South Atlantic	34.1000N	084.4400W
Charleston	32.4600N	079.5700W
Jacksonville	30.1842N	081.4024W
Mobile	30.4000N	088.0500W
Savannah	32.0500N	081.0500W
Wilmington	34.1400N	077.5700W
South Pacific	37.4800N	122.2400W
Los Angeles	34.0300N	118.1400W
Sacramento	38.3405N	121.2750W
San Francisco	37.4800N	122.2400W
South Western	32.4643N	106.3700W
Albuquerque	35.0300N	106.3700W
Fort Worth	32.4558N	097.1953W
Galveston	29.1600N	094.5200W
Little Rock	34.4500N	092.1700W
Tulsa	36.0875N	095.5934W

APPENDIX E

BASIC "TURN-ON" OF "RADIO EQUIPMENT ONLY"



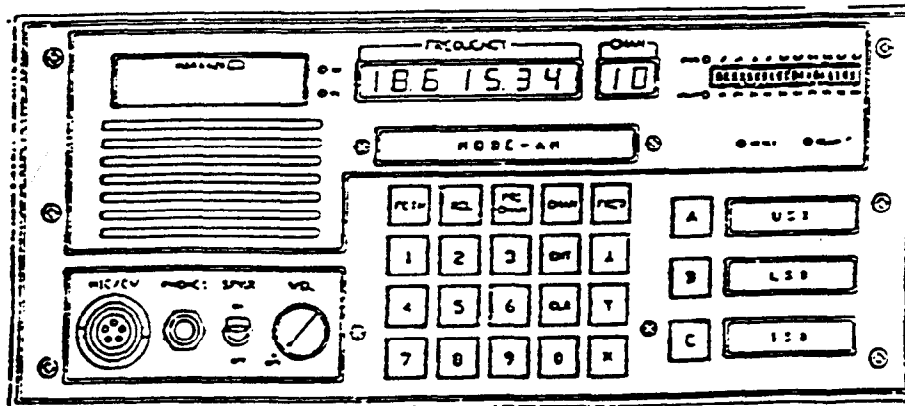
STEP # 1



SPEAKER
"ON/OFF"
SWITCH, SET
TO "ON"
POSITION

"ON/OFF VOLUME
CONTROL, TURN
"ON", SET TO
"11:00" O CLOCK
POSITION.

STEP # 2 UPPER CONTROL UNIT
IN CONSOLE, CONTROLS A RADIO
RECEIVER ONLY.



"ON/OFF" VOLUME CONTROL AND
SPEAKER "ON/OFF" SWITCH SET
SAME AS IN "STEP 2"

STEP # 3 LOWER CONTROL UNIT
IN CONSOLE, CONTROLS A RADIO
RECEIVER AND RADIO TRANSMITTER

NOTE: AFTER THESE STEPS ALL REQUIRED RADIO EQUIPMENT IS "ON"

BASIC CONTROL OPERATOR INFORMATION
MSR 6420 CONTROL UNIT (LOWER UNIT ON CONSOLE)
" HOW TO OPERATE RADIO SYSTEM "

1. MAKE SURE BASIC " TURN ON " OF SYSTEM (PAGE 4) HAS BEEN PERFORMED.
2. CHECK PAGES 2 THRU 3 FOR REQUIRED FREQUENCY AND RADIO CHANNEL NUMBER THAT CONTAINS REQUIRED FREQUENCY.
3. OPERATOR SHOULD RECHECK ACCURACY OF STEPS 1- AND 2 ABOVE.

KEY/SELECT FUNCTIONS OPERATOR MUST PERFORM.

1. PRESS " CHAN " KEY FIRMLY, (1 PRESS ONLY).
NOTE: STATUS WINDOW WILL INDICATE " CHANNEL MODE "
2. ENTER REQUIRED NUMERICAL CHANNEL NUMBER , (NUMBER KEYS 1 THRU 0),

NOTE: EACH CHANNEL NUMBER MUST HAVE A 2 DIGIT ENTRY. EXAMPLE,
CHANNEL 4 WILL BE ENTERED AS 04, CHANNEL 12 WILL BE ENTERED AS 12.

MAXIMUM NUMBER OF CHANNELS FOR SYSTEM IS 99.

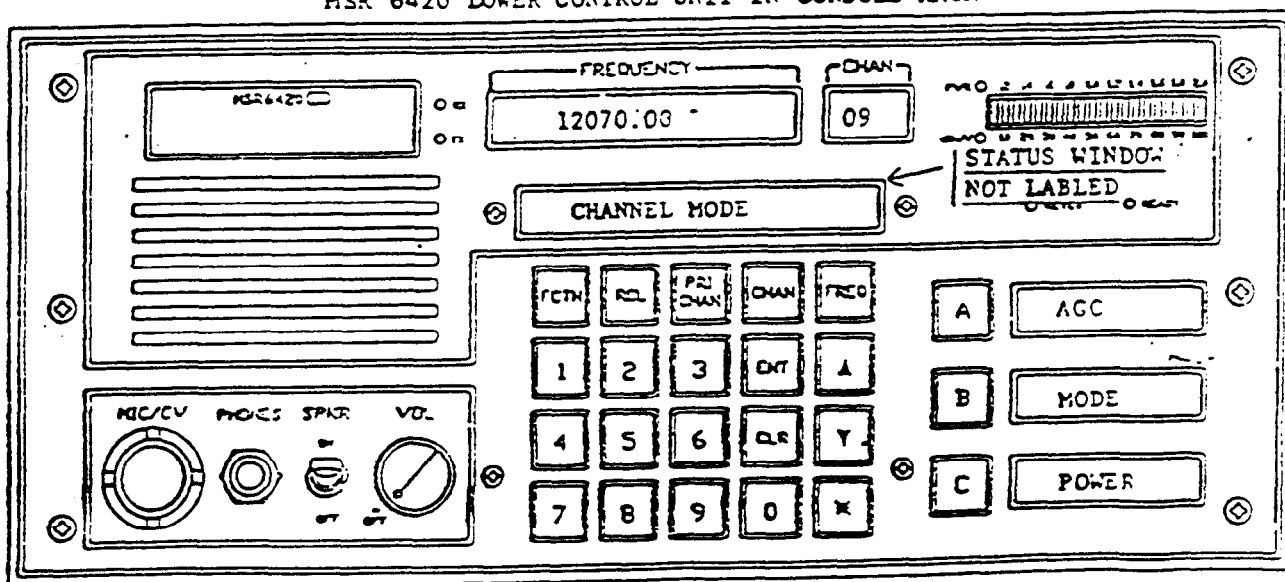
PRESS NUMBER KEYS FIRMLY (1 PRESS ONLY).

3. WHEN CHANNEL NUMBERS HAVE BEEN KEYED " IN ", REQUESTED CHANNEL NUMBER WILL APPEAR IN " CHAN " READOUT WINDOW. EXAMPLE 09/12, ETC..
WHEN THE CHANNEL NUMBER APPEARS THE FREQUENCY OF THAT CHANNEL WILL ALSO APPEAR IN THE " FREQUENCY " WINDOW. EXAMPLE (FROM PAGES 2 OR 3),
CHANNEL 09, FREQUENCY 12070.0, CHANNEL 12, FREQUENCY 16382.0.
4. OPERATOR WILL RECHECK FOR ACCURACY OF REQUIRED FREQUENCY AND CHANNEL.
OPERATOR WILL NOW PRESS ENTER " ENT " KEY FIRMLY, (1 PRESS ONLY).
THE SYSTEM WILL NOW GO THROUGH AN AUTOMATIC CYCLE FUNCTION. FUNCTIONS WILL FLASH ON THE STATUS WINDOW (WINDOW DIRECTLY BELOW FREQUENCY AND CHAN WINDOWS). MAXIMUM TIME LENGTH FOR ALL FUNCTIONS TO " LOCK "
WILL BE 40 SECONDS. TYPICAL STATUS WINDOW FLASHING DATA: "COUPLR IS TUNING", "CPLR=READY: S=OFF", FINAL " LOCKED" STATUS "RCVR=02 XCTR=01".
RADIO IS NOW "READY" FOR OPERATION FROM LOWER MSR 6420 CONTROL UNIT.
NOTE: THE UPPER MSR 6420 CONTROL UNIT IS NOT REQUIRED FOR STANDARD/NORMAL RADIO COMMUNICATIONS.

" HOW TO OPERATE RADIO SYSTEM "

5. OPERATOR WILL NOW PICK UP MICROPHONE, THAT IS CONNECTED TO CONTROL UNIT, PLACE MICROPHONE (SIDE WAYS) NEAR CHEEK, AND APROX. 1 INCH FROM LIPS, AND TALK ACROSS FACE OF MICROPHONE, NEVER TALK DIRECTLY OR CLOSE TO FACE OF MICROPHONE, TALK CLOSE AND ACROSS FACE OF MICROPHONES. MICROPHONE PUSH-TO-TALK SWITCH MUST BE PRESSED "IN" (FIRMLY) AND HELD WHILE TRANSMITTING, THEN PUSH-TO-TALK SWITCH MUST BE RELEASED TO RECEIVE RESPONSE FROM STATION CALLED/CONTACTED. WHEN RADIO COMMUNICATIONS FINISHED/MISSION TERMINATED , THE OPERATOR WILL NOT BE REQUIRED TO "TURN OFF" RADIO SYSTEM UNLESS REQUESTED TO "DO SO" BY EMERGENCY MANAGER.

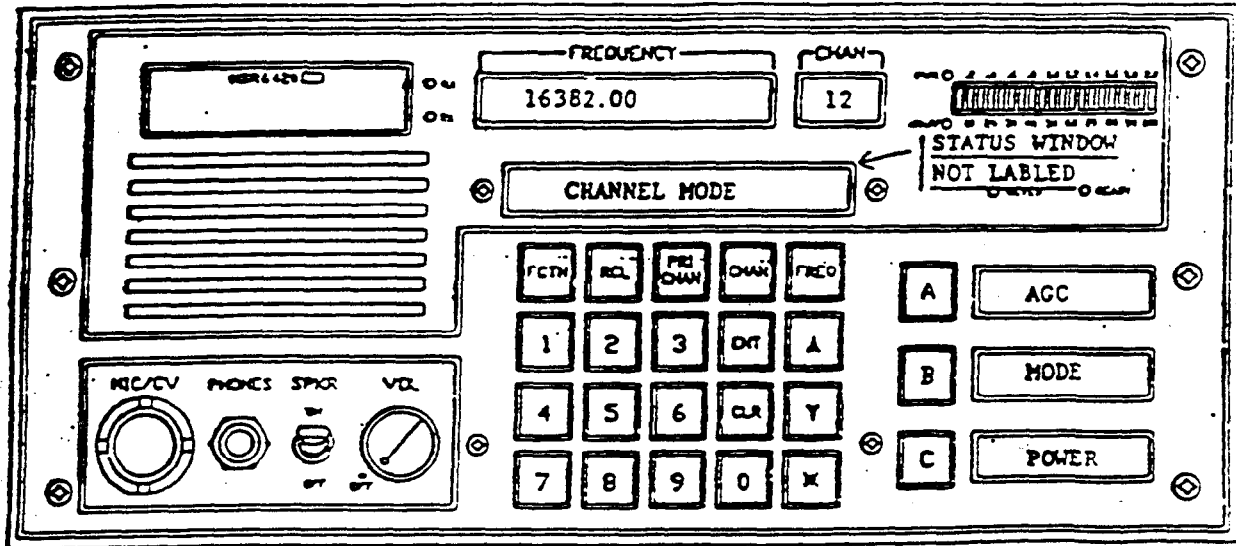
MSR 6420 LOWER CONTROL UNIT IN CONSOLE RACK



EXAMPLE: SELECT CHANNEL 09

THIS UNIT CONTROLS BASIC TRANSMITTER AND RECEIVER

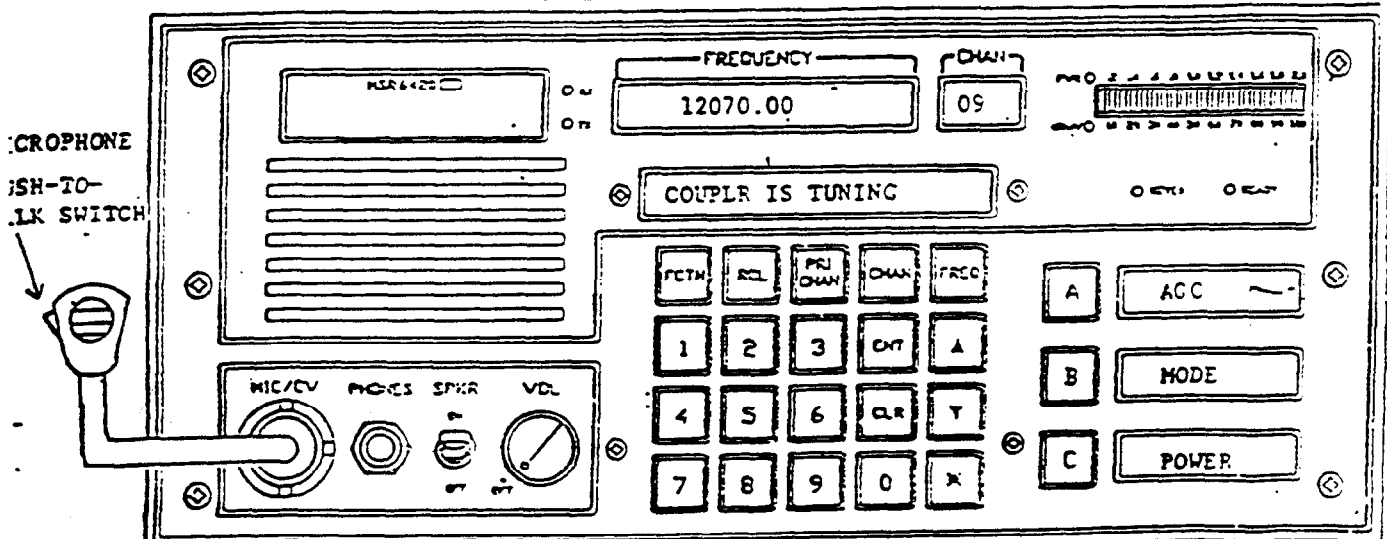
MSR 6420 LOWER CONTROL UNIT IN CONSOLE RACK



EXAMPLE: SELECT CHANNEL 12

THIS UNIT CONTROLS BASIC TRANSMITTER AND RECEIVER

MSR 6420 LOWER CONTROL UNIT IN CONSOLE RACK

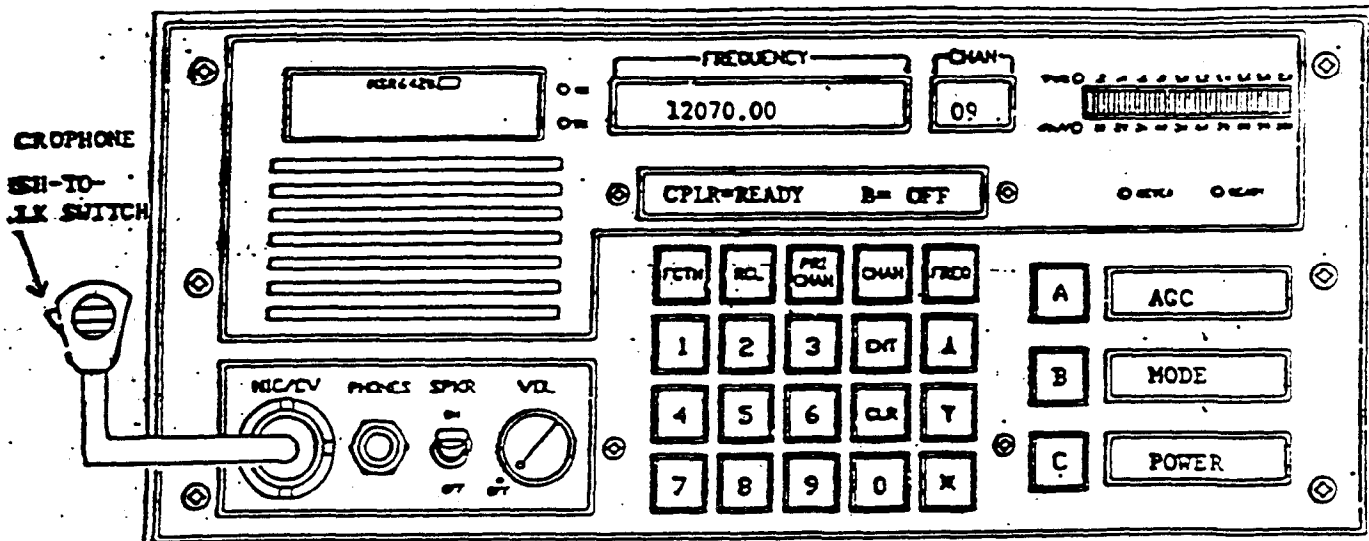


← MICROPHONE
ISH-TO-
LK SWITCH

EXAMPLE: SELECT CHANNEL 09,
KEY "ENT", FIRST STATUS WINDOW
INDICATION "COUPLR IS TUNING"

THIS UNIT CONTROLS BASIC TRANSMITTER AND RECEIVER

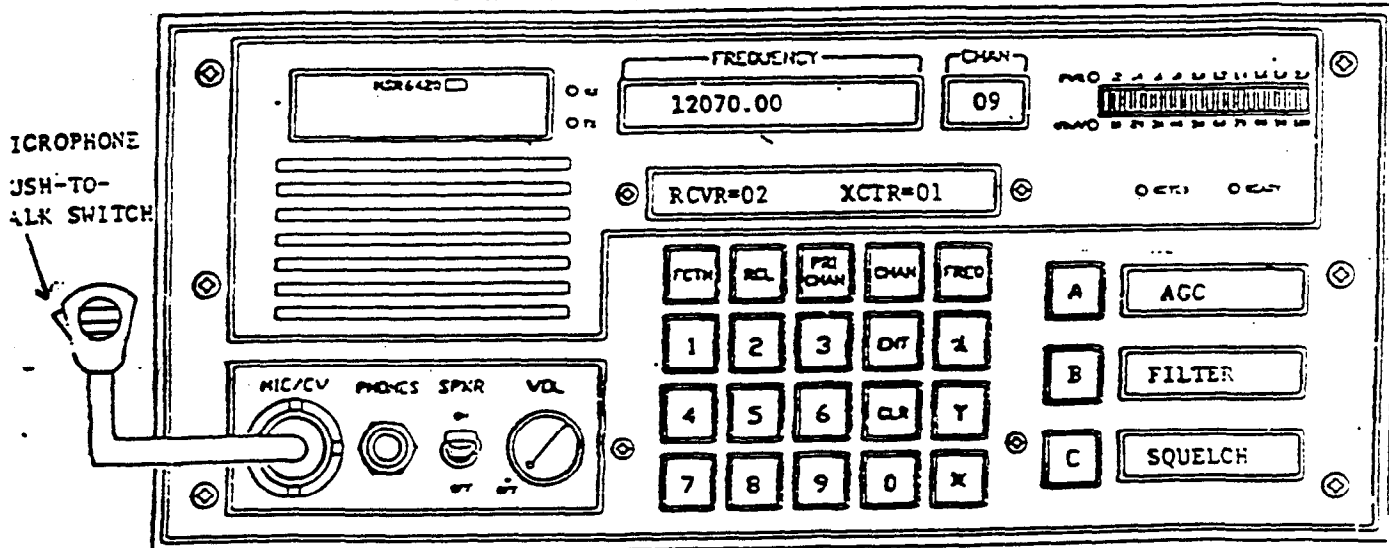
MSR 6420 LOWER CONTROL UNIT IN CONSOLE RACK



EXAMPLE: SELECT CHANNEL 09,
SECOND STATUS WINDOW INDICATION,
"CPLR=READY B= OFF"

THIS UNIT CONTROLS BASIC TRANSMITTER AND RECEIVER

MSR 6420 LOWER CONTROL UNIT IN CONSOLE RACK



EXAMPLE: SELECT CHANNEL 09,
THIRD AND FINAL STATUS WINDOW
INDICATION "RCVR=02 XCTR=01",
SYSTEM IS NOW READY FOR OPERATION ON CHANNEL 09.

THIS UNIT CONTROLS BASIC TRANSMITTER AND RECEIVER

S U M M A R Y

STEP:

1. TURN "ON" RADIO SYSTEM. (ALLOW 1 MINUTE FOR WARM UP).
2. PRESS "CHAN" KEY.
3. SELECT REQUIRED CHANNEL WITH "NUMBER KEYS" (1 THRU 0).
4. PRESS "ENT" KEY.
5. WAIT APROX. 45 SECONDS FOR RADIO SYSTEM TO COMPLETE TUNING CYCLE AND "STATUS WINDOW" INDICATES " RCVR=02 XCTR=01" RADIO IS READY FOR USE.

SPECIAL NOTE: THESE SAME STEPS MUST BE PERFORMED
EACH TIME A CHANNEL IS CHANGED.

TO PROGRAM THE RADIO SYSTEM

1. MAKE SURE RADIO SYSTEM IS TURNED "ON" AS DESCRIBED ON PAGE 4 .
2. SELECT A CHANNEL NUMBER: DO NOT USE CHANNEL NUMBERS LISTED ON PAGES 2 AND 3. PRESS "CHAN" KEY, STATUS WINDOW WILL INDICATE "CHANNEL MODE", MENU KEY WINDOWS WILL INDICATE, A/ACC, B/MODE, C/POWER. NEXT, USING NUMERICAL KEYS, SELECT A 2 DIGIT CHANNEL NUMBER AND PRESS, 1 KEY AT A TIME. EXAMPLE 43, 43 WILL APPEAR IN THE "CHAN" WINDOW, STATUS AND MENU WINDOWS WILL NOT CHANGE.
3. SELECT A FREQUENCY: PRESS "FREQ" KEY, STATUS WINDOW WILL INDICATE "ENTER FREQUENCY" , MENU WINDOWS WILL GO BLANK A/B/C/ (BLANK). USING NUMERICAL KEYS SELECT REQUIRED FREQUENCY, EXAMPLES , 03970.00 (3970.00 Khz), OR 14250.00 (14250.00 Khz), SELECTED FREQUENCY WILL APPEAR IN "FREQUENCY" WINDOW. NEXT PRESS "ENT" KEY. STATUS WINDOW WILL RETURN TO "CHANNEL MODE" AND MENU WINDOWS WILL RETURN TO A/ACC, B/MODE, C/POWER.

NOTE: NEXT STEPS ARE SELECT MENUS.

1. WINDOW "A" ACC , 4 SELECTIONS, PRESS WINDOW A KEY, MENU WILL APPEAR, A/OFF, B/SLOW, C/MED; PRESS "FCTN", MENU WILL SCROLL TO, A/FAST, B/BLANK, C/BLANK, PRESS "FCTN" AGAIN TO SCROLL BACK FIRST A/B/C. STANDARD "ACC" SELECTION IS FIRST MENU SELECTION "C/MED". PRESS MENU KEY "C", STATUS WINDOW WILL INDICATE "ACC MED" FOR A FEW SECONDS, THEN RETURN TO "CHANNEL MODE"
2. WINDOW "B" MODE , 8 SELECTIONS, PRESS WINDOW B KEY, MENU WILL APPEAR, A/ISB, B/AM, C/CW, PRESS "FCTN" MENU WILL SCROLL TO, A/USB, B/LSB, C/FSK, PRESS "FCTN" MENU WILL SCROLL TO, A/A3A, B/FM, C/BLANK, PRESS "FCTN" AGAIN SCROLL TO MENU A/USB, B/LSB, C/FSK. STANDARD MODE SELECTIONS WILL BE A/USB, OR B/LSB, AS REQUIRED. PRESS KEY A OR B, STATUS WINDOW WILL INDICATE "MODE USE" OR "MODE LSB" FOR A FEW SECONDS , THEN RETURN TO "CHANNEL MODE".

3. WINDOW "C" POWER , 4 SELECTIONS , PRESS WINDOW C KEY , MENU WILL APPEAR ,
A/LEVEL 1 , B/LEVEL 2 , C/LEVEL 3 , PRESS "FCTN" MENU WILL SCROLL TO ,
A/LEVEL 4 , B/BLANK , C/BLANK. STANDARD POWER LEVELS WILL BE "C/LEVEL 3" ,
FIRST SCROLL OR "A/LEVEL 4" SECOND SCROLL. SELECT POWER LEVEL , PRESS
MENU KEY , STATUS WINDOW WILL INDICATE "PWR LEV: LEVEL 3" FOR A FEW SECONDS ,
THEN RETURN TO "CHANNEL MODE".
4. NEXT: PRESS "FCTN" KEY TO SCROLL NEW MODE MENU.
NEW MODE MENU WILL INDICATE , A/FILTER , B/BFO , C/BLANK.
5. WINDOW "A" FILTER , 5 SELECTIONS , PRESS WINDOW A KEY , MENU WILL APPEAR ,
A/V WIDE , B/WIDE , C/MEDIUM , PRESS "FCTN" MENU WILL SCROLL TO A/NARROW ,
B/V NARROW , STANDARD FILTER IS MEDIUM , PRESS "FCTN" , SCROLL TO FIRST MENU ,
PRESS MENU KEY "C/MEDIUM" , STATUS WINDOW WILL INDICATE "FILTER MED" , FOR
A FEW SECONDS , THEN RETURN TO "CHANNEL MODE".
6. WINDOW "B" BFO , 2 SELECTIONS , PRESS WINDOW B KEY , MENU WILL APPEAR.
A/+, B/- , NOTE: WHEN "B" BFO KEY IS PRESSED , STATUS WINDOW SHOULD READ ,
"IS - 000 BFO___" (THIS IS CORRECT INDICATION) , IF THIS IS NOT TRUE ,
CORRECT TO THIS STATUS. EXAMPLE "IS + 100 BFO___" , CORRECT BY PRESSING
B/- KEY (- 100) , THIS WILL CANCEL AND EQUAL 000. AT THIS TIME PRESS
"ENT" KEY FIRMLY , 1 TIME . STATUS WINDOW SHOULD INDICATE "IS - 000 BFO___"
7. NEXT: PRESS "ENT" KEY 1 MORE TIME , FIRMLY. THIS IS FINAL STEP FOR
PROGRAMMING RADIO SYSTEM.
8. RADIO SYSTEM WILL GO THRU TUNING CYCLE , STATUS WINDOW INDICATIONS ,
"COUPLR IS TUNING" , "CPLR=READY B=OFF" , "RCVR=02 XCTR=01" , MENU
WINDOWS A/ACC , B/FILTRT , C/SQUELCH. SYSTEM IS NOW READY FOR OPERATION
ON NEW CHANNEL.
9. SPECIAL NOTE: WHEN MAKING MENU SELECTIONS IF STATUS WINDOW INDICATES
THE DESIRED SELECTION IS "OK" PRESS "CLR" KEY , FIRMLY , 1 TIME , TO CLEAR
THAT MENU. PRESS "FCTN" KEY FOR OTHER MENUS

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INTRODUCTION.

The Department of the Army high frequency single sideband (HF/SSB), radio, manufactured by Harris Corp., is designed to be transportable. Therefore, it should be installed as a portable unit.

The primary function of this radio is to maintain communications with state and local agencies in times of emergency. The secondary function of the radio is interoperability with the corps of engineers natural disaster HF/SSB nets.

The radio Operating Procedures in this manual will be used when operating either the Mackay or Harris radios. In addition, this Appendix contains packet radio operating instructions. At this time Packet is an OPTION that is under consideration for use with the Harris radio.

FREQUENCIES.

Channels 1 through 13 and the assigned frequencies, as shown on page 3 of this manual, will be programmed into the Harris radio. The radio is capable of storing channel and frequency information for 100 channels. Channels 14 and above shall be used to store frequencies that your station has authority to use by virtue of a Memorandum of Understanding (MOU) with such agencies as the national guard, etc. Programming should include the two FEMA frequencies listed on page 3 of this manual.

RADIO USAGE

Each Field Operating Activity (FOA) should establish a Memorandum of Understanding (MOU) with the respective state Adjutant Generals (TAG) office and the State Emergency Management Agency that would allow single side band communications with those departments during an emergency situation.

During an emergency US Army Corps of Engineers users should use the Mackay SSB radio for communications on the US Army Corps of Engineers nets and use the Harris for communications with state and local agencies.

FOAs will substitute their Harris system for the Mackay system once per month on the Corps of Engineers radio nets. This is necessary to ensure that operators will be able to operate the Harris system when the need arises.

The last communications net in each month will be designated for Harris radio system use. Stations should be prepared to use the packet radio mode of operation as directed by the NCS. (If PK-232 has been distributed and installed).

The Harris radio system will also be used as backup for the Mackay at any time the Mackay is inoperative, unavailable or if it is necessary to operate from a remote location.

All users should be familiar with setting up and operating the Harris system under field conditions, using emergency power and field expedient antennas. Where possible, users should exercise emergency power sources in field locations or simulated field conditions with portable antenna, on the one radio net per month that the Harris is used.

The following instructions apply to operating the Harris radio on the established CORPS OF ENGINEERS radio nets. They may or may not apply to operations with state and local agencies, dependent upon the type of equipment used by those agencies.

PROGRAMMING THE RT 1446:

1. Press 2nd-PROG. Observe CHAN indicator illuminates.
2. Enter the CHANNEL number from 00 to 99 with the keypad, then press ENTER. Observe FREQ indicator illuminates.
3. Enter the frequency assigned to the channel, per the operating plan (using the numeric keypad).
4. Repeatedly press MODE until the desired communications mode is displayed. i.e. (USB, LSB, AM, CW, etc.).
5. Check that the displayed frequency and mode are correct, then press 2nd-LOAD.
6. Repeat the process for the other channels.

Other operating parameters must be handled manually after the channel has been selected.

CHANNEL SELECTION

Channels can be selected once they have been previously programmed. These instructions assume that the required channels have been programmed.

1. Press **CHAN**.
2. Enter the **CHAN** Number Desired.
3. Press **ENTER**. Observe channel number and the preprogrammed frequency appear in the display.

GUARD FREQUENCY

The Corps Of Engineers Net Control Station (NCS), alternate Net Control Station (ANCS) and the Critical Relay Stations (CRS) will use separate receiving equipment to monitor the following frequencies at all times that a Corps emergency net or exercise is in progress. In an emergency situation it is feasible that some stations may become confused as to what frequency the net is operating on, or be unable to communicate on that frequency for some reason. In such an instance those stations should call NCS, ANCS or CRS stations listed in this manual on the following frequency/time slots:

<u>Time (in zulu)</u>	<u>Frequency</u>	<u>Channel</u>
0000-1100	5015.0 USB	2
1100-1500	9122.5 USB	8
1500-2600	16077.0 USB	12

NOTE

IF THE NEED ARISES TO ACTIVATE THE CE EMERGENCY SSB RADIO NET WITHOUT PRIOR NOTIFICATION AS TO CHANNEL TO BE USED THE NET WILL BE OPENED ON ONE OF THE ABOVE LISTED CHANNELS IN ACCORDANCE WITH THE TIME SLOTS SHOWN.

ZULU TIME

Current Zulu time can be ascertained by tuning HF receiver to frequency 5.0 10.0 15.0 or 20.0 MHz. These frequencies are used by the national bureau of standards to broadcast correct time at one minute intervals. This time is given in Greenwich Mean Time, which is the same as Zulu.

LINK QUALITY ANALYSIS (LQA) AND SELECT CALL ADDRESS NUMBERS.

The RF-7110 Adaptive Controller accomplishes transceiver control; automatic linking, for link quality analysis (LQA) and traffic handling. The control functions performed by the Adaptive Controller have to be programmed.

To put the RF-7110 Adaptive Controller into Operation, the transceiver must be in the REMOTE mode of operation. Press 2ND+REMOTE on the transceiver front panel after activating the 7110.

To exercise complete control of the transceiver, the 7110 must be programmed with the assigned network channels and frequencies. This is accomplished using the procedures outlined in Fig. 1 item 1.

For standardization the Adaptive Controller BAUD rate will be set at 200 and the Preamble Length will be set at 45. This is accomplished using the procedures outlined in Fig. 2 items 5 & 6.

Each Adaptive Controller must be assigned a four digit number (local call-sign) for use in performing LQA and Station Linking (Select Call). To program the local call-sign see Fig. 1 item 2. The call-signs for each station in the net also must be programmed in the local 7110. This is accomplished using the procedures of Fig. 1 item 3.

Corps Stations have been assigned the following address indicators (call-signs), and will program their 7110s accordingly.

ADDRESS CODES ARE ASSIGNED AS FOLLOWS;

CEHND, Huntsville AL	2101
CEETL, Ft. Belvoir VA	2102
CECRL, Hanover, NH	2103
CEWES, Vicksburg MS	2104
CECER, Champaign IL	2105
CEHEC, Ft. Belvoir VA	2106
HQUSACE	2110

CELMV DIVN OFC VICKSBURG MS.(NCS)	2111
Memphis Dist.	2112
New Orleans Dist.	2113
St. Louis Dist.	2114
 CEMRD, OMAHA NB.	 2210
Kansas City Mo. Dist.	2211
 CENED, WALTHAM MA.	 2310
 CENAD, NEW YORK, NY.	 2311
Baltimore Dist.	2312
Norfolk Dist.	2313
Philadelphia Dist.	2314
New York Dist.	2315
 CENCD, 'CHICAGO, IL.	 2410
Buffalo Dist.	2411
Detroit Dist.	2412
Rock Island Dist.	2413
St. Paul Dist.	2414
Chicago Dist.	2415
 CENPD, PORTLAND OR.	 2510
Anchorage, AK. Dist.	2511
Seattle Dist.	2512
Walla Walla Dist.	2513
Portland Dist.	2514
 CEORD, CINCINNATI OH.	 2610
Huntington Dist.	2611
Louisville Dist.	2612
Nashville Dist.	2613
Pittsburg Dist.	2614
 CESAD, ATLANTA GA.	 2710
Charleston SC Dist.	2711
Jacksonville Fl. Dist.	2712
Mobile Dist.	2713
Savannah, Ga. Dist.	2714
Wilmington, NC. Dist.	2715
 CESPD, SAN FRANCISCO CA.	 2810
Los Angeles Dist.	2811
Sacramento Dist.	2812
San Francisco Dist.	2813

CESWD, DALLAS TX.	2910
Albuquerque NM.	2911
Fort Worth Dist.	2912
Galveston Tx. Dist.	2913
Little Rock Dist.	2914
Tulsa Dist.	2915

To call all stations in the Corps use 2000. To call all stations in a group (e.g. Labs; each Division and their Districts form individual groups), use 2X00 where X is the second number in that group.

While stations having Address Codes 2101 thru 2106 only have a Harris Radio system, the instructions contained in this Appendix and basic manual apply to their operation as well. Additionally they will participate as Stand - alone FOA elements during regular Corps net operations and exercises.

Appropriate call signs and station data for each is as follows:

<u>SITE</u>	<u>REG CALL</u>	<u>ARO CALL</u>	<u>PHONE NUMBER</u>
HUNTSVILLE DIV CEHND HUNTSVILLE AL	WUL	WWUL	205-895-3296
TOPO LAB CEETL FORT BELVOIR VA	WUM	WWUM	202-355-3021
COLD RGN RSCH & ENGR LAB CECRL HANOVER NH	WUN	WWUN	603-646-4392
WTRWYS EXPER STA CEWES VICKSBURG MS	WUP	WWUP	601-634-4012
CONST ENGR LAB CECER CHAMPAIGN IL	WUQ	WWUQ	217-373-7287
HUMPHREYS ENG CTR CEHEC FT BELVOIR, VA	WUR	WWUR	202-355-3656

The Link Quality Analysis (LQA) function. Each Mackay HF/SSB radio set is issued with a PC software program for HF Radio Propagation Calculation. This software calculates the Maximum Usable Frequency (MUF) for the location end points, the time of year (date), and appropriate sunspot, atmospheric conditions. To enhance this resultant information, the RF-7110 Adaptive Controller provides a service for determining the Maximum Observable Frequency (MOF) and ranking of grade of service over any given HF link. This service is called the Link Quality Analysis (LQA). An LQA can be performed between any two HF links with RF-7110s, in the Corps nets. The procedures for conducting such an analysis are contained in Fig. 4 items 4, 5 & 6.

OPTIONAL PACKET RADIO OPERATIONS

The Packet Radio (PAKRATT) Multi-Mode Data Controller, Model PK-232, with a PC and PC-PAKRATT software is a type of data system used to pass data traffic on an HF Radio Net. The PK-232 controller is being considered as the standard HF data interface device for use on the Corps nets. Several Corps stations have procured the PK-232.

The PK 232 Controller provides the following types of data transmission service when coupled with a computer (PC) and a radio transmitter/receiver:

- a. **PACKET.** Error correcting by the receiving station automatically re-sending received data to the transmitting station for verification prior to printing information.
- b. **DIGIPEAT.** In the Packet mode your station can be used by other stations as a relay station. In this function your station is simply acting as a relay station between two other stations that are unable to connect and pass traffic directly due to distance or atmospheric conditions. Serving as a digipeater requires no action by the operator. Your station is connected automatically by the originator and their signals are retransmitted by your radio to the receiving station.
- c. **AMTOR - ARQ.** Same principal as packet except that where packet transmits a burst of many characters on each transmission cycle, ARQ transmits only three (3) characters per burst. (NOTE; ARQ on the PK-232 is the same as ARQ mode on the Mackay radio.
- d. **BAUDOT.** This mode is actually radioteletype and is compatible with the RTTY program on the Mackay radio.

NOTE:

When the PK-232 w/Harris or Mackay radios is used to communicate with the Mackay w/out PK-232 via Baudot/RTTY operation, the baud rate on the radio w/PK-232 should be set at 75 and the baud rate on the Mackay set at 100.